SPECIAL PROCUDURE
(LGIS)

SMALL BOWEL SERIES (SBS)

- Radiographic study of the small intestine
- Done at timed intervals
- **Small Bowel Follow-Through (SBFT):** when SI is studied in combination of UGIS-SBS
- **Purposes:**
  - To study the form and function of the three components of the SI
  - To detect any abnormal conditions
- **Performed by:**
  - UGI-SB combination (Mouth)
  - Complete reflux filling
    - Large volume BE
  - Enteroclysis/small bowel enema
    - Direct injection into bowel through an intestinal tube
    - Difficult to performed
  - Intubation Method
- **BE & Enteroclysis:** used when oral method fails to provided conclusive information

CONTRAINDICATIONS

- Presurgical patients
- Patients with perforated hollow viscus (intestine or organ)
  - $BaSO_4$ should not be used
  - **CM used:** water-soluble iodinated
    - Care must be taken to **young** or **dehydrated** patients
- Possible large bowel obstruction

PATHOLOGIC INDICATIONS

- Regional enteritis (Crohn's Disease)
- Enteritis
- Giardiasis
- Ileus
  - Adynamic/paralytic
  - Mechanical ileus
- Meckel's diverticulum
- Sprue
- Malabsorption syndrome

PATIENT PREPARATION

- Soft residue diet for 2 days
- NPO after evening meal of the day before the examination
- NPO (breakfast) on the day of the study
- Cleansing enema/cathartics
  - **Purpose:** to clear the colon
- Bladder should be empty before and during the procedure
  - **Rationale:** to avoid displacing and compressing ileum

PRELIMINARY FILM

- Plain AP Abdomen (KUB)

POSITION OF THE PATIENT

- Supine/prone
- **Purpose of Supine:**
  - To take advantage of the superior and lateral shift of the barium-filled stomach
    - For visualization of retrogastric portions of the duodenum and jejunum
  - To prevent possible compression overlapping loops of the intestine
- **Purpose of Prone:**
  - To compress the abdominal contents
    - Increases radiographic quality
  - To separate the various loops of bowel
    - Creates higher degree of visibility

SPECIAL PROCUDURE
(LGIS)

- **Trendelenburg Position:**
  - For final radiograph in asthenic patient
  - **Purpose:**
    - To unfold low lying and superimposed loops of the ileum
    - To separate overlapping loops of ileum

LOCATIONS OF LARGE INTESTINE STRUCTURES IN RELATION TO PERITONEUM

- **Intraperitoneal:** within peritoneal cavity
- **Retroperitoneal:** behind peritoneal cavity
- **Cecum:** intraperitoneal
- **Ascending colon:** retroperitoneal
- **Transverse colon:** intraperitoneal
- **Descending colon:** retroperitoneal
- **Sigmoid colon:** intraperitoneal
- **Upper rectum:** retroperitoneal
- **Lower rectum:** intraperitoneal

RELATIVE LOCATIONS OF AIR AND BARIUM IN LARGE INTESTINE

- **Supine Position**
  - **Air:** rises and fills the most anterior structures (intraperitoneal structures)
  - **Barium:** sinks and fills the most posterior structures (retroperitoneal structures)
- **Prone Position:** reversed the above mentioned

UGI-SB COMBINATION (Bontrager)

- Routine GI first
- **Barium:** 1 full cup (8 oz); time noted
- **Second cup:** after routine GI; time noted
- 30-minute PA radiograph
  - IR centered high for proximal SB
- 30-minute interval radiographs
  - IR centered to iliac crest
  - **Finished:** when barium reaches ileocecal valve (usually 2 hours)
- 1-hour interval radiographs
  - If more time is needed after 2 hours

SMALL BOWEL SERIES ONLY (Bontrager)

- **Scout:** plain abdomen radiograph
- **Barium:** 2 cups (16 oz); noting time
- **First radiograph:** 15-30 minute radiograph
  - IR centered high for proximal SB
- **Second radiograph:** half hour interval radiograph
  - IR centered to iliac crest
  - **Finished:** when barium reaches ileocecal valve (usually 2 hours)
- 1-hour interval or continuous half-hour interval radiographs
  - If more time is needed after 2 hours

COMPLETE REFLUX EXAMINATION

- Administer BE
  - To demonstrate colon and small bowel
- **Preparation before exam:**
  - Glucagon
    - **Rationale:** to relax intestine
  - Diazepam/Valium
    - **Rationale:** to diminish patient discomfort
- **Materials:**
  - Retention tip enema
  - Enema bag
- **Barium suspension:** 15 +/- 5% weight/volume
  - **4500 mL:** required to fill the colon and small intestine

- Allowed to flow until observed in **duodenal bulb**
  - Enema bag is lowered
  - Radiographs are taken

ENTEROCLYSIS (Bontrager)

- Injection of a nutrient or medicinal liquid into the bowel
  - **Material:** special enteroclysis catheter (**Bilbao/Sellink tube**)
  - **Site:** duodenojejunal junction (ligament of Treitz)
- Double contrast method
  - Barium
    - **Rate:** 100 mL/minute
  - Air or methylcellulose
    - **Purpose:** used to distend the lumen of bowel
- **Indication:** patient with
  - History of small bowel ileus
  - Regional enteritis (Crohn's Disease)
  - Malabsorption syndrome
- **Advantages:**
  - Enhances the visibility of the mucosa (double contrast effect)
  - Increases the accuracy of the study
- **Disadvantages:**
  - Increased patient discomfort
  - Increased possibility of bowel perforation during catheter placement

ENTEROCLYSIS PROCEDURE (Bontrager)

- **Preparations:**
  - Colon must be thoroughly cleansed
    - Enemas not recommended
      - **Rationale:** enema fluid may retained in the SI
- Special catheter advanced to duodenojejunal junction (near ligament of Treitz)
  - Under fluoroscopic control
- Thin mixture of barium sulfate instilled
  - **Rate:** 100 mL/minute
- Air or methycellulose instilled
- Fluoroscopic spot images and conventional radiographs taken
- CT may be performed
  - Iodinated CM or tap water must be used

GASTROINTESTINAL INTUBATION METHOD

- The procedure in which a long, specially designed tube is inserted through the nose and passed into the stomach
- Small bowel enema
- Single-contrast small bowel series
- For diagnostic & therapeutic purposes
- **Materials:** Nasogastric tubes
  - Single-lumen tube
    - **Site:** proximal jejunum
    - **Patient:** RAO position (gastric peristalsis more active)
      - Aid in passage of tube
  - Miller-Abbott (M-A) tube
    - A double-lumen tube
    - For therapeutic intubation
    - **Site:** proximal jejunum
- **Therapeutic intubation**
  - **Purposes:**
    - To relieve postoperative distention
    - To decompress a SB obstruction

SPECIAL PROCUDURE
(LGIS)

INTUBATION METHOD PROCEDURE (Bontrager)

- Single-lumen catheter advanced to proximal jejunum
    - **Double lumen:** used for therapeutic intubation
- Water-soluble iodinated CM or thin mixture of $BaSO_4$ instilled (time noted)
- Conventional radiograph of fluoroscopic spot images taken (at specific time intervals)

SMALL BOWEL SERIES PROCEDURE (Ballinger)

- **First radiograph:** 15 minutes
    - After the patient drinks the barium
- **Second radiograph:** b/n 15-30 minutes
    - Depends on transit time of barium
- **Glass of ice water/food stimulant:**
    - For patient with hypomotility
    - Given after 3-4 hours of administering barium
    - **Purpose:** to accelerate peristalsis
- **Alternative methods to stimulate peristalsis:**
    - Water-soluble CM, tea or coffee
    - Peristaltic stimulants every 15 minutes
- **Examination:** completed in **30-60 minutes**

SPECIAL PROCUDURE
(LGIS)

POSITIONING ROUTINES

PA/AP PROJECTION

PP: Prone/supine
RP:

- **Early Radiographs:**
  - L2 – Ballinger
  - 2 in. above iliac crest - Bontrager
- **Late Radiographs:**
  - Iliac crest

CR: Perpendicular
SS: Barium-filled small intestine

- **30-minutes radiograph:** barium location
  - Stomach and jejunum
- **1-hour radiograph: l**barium location
  - Jejunum
- **2-hour radiograph:** barium location
  - Ileum and proximal colon

When barium reached ileocecal valve:

- Fluoroscopy is performed
- Compression radiographs are obtained
- **Exam Completed:** when barium reached **cecum**
  - 2 hours (for normal intestinal motility)

LOWER GASTROINTESTINAL SERIES

BARIUM ENEMA/LOWER GI SERIES

- Radiographic examination of the large intestine
- **Purposes:**
  - Radiographically study the form and function of the large intestine
  - To detect any abnormal conditions

CONTRAINDICATIONS

- Possible perforated hollow viscus
- Possible large bowel obstruction
- **CM used:** water-soluble iodinated CM
- Previous surgical examination
- Acute appendicitis
  - UTZ or CT may be performed

PATHOLOGIC INDICATIONS

- Colitis
- Ulcerative colitis
- Diverticulum
- Intussusception
- Polyps
- Volvulus
- Cecal volvulus

PATIENT PREPARATION

- Same in SBS
- LI must be completely empty
  - **Rationale:**
    - To render all portions of its inner all visible for inspection
    - Retained fecal material may stimulate appearance of polypoid or small tumor masses
- Dietary restriction
- Bowel cleaning regimen
  - Complete intestinal tract cleansing kits
  - GI lavage preparations
  - Cleansing enema (laxatives)
- Laxatives/cathartics/enema
  - **Two classes:**
    - Irritant laxative – castor oil (rare used today)
    - Saline laxative – magnesium citrate or magnesium sulfate

- **Purpose:** to empty alimentary canal
- **Contraindicated:** patient with
  - Gross bleeding
  - Severe diarrhea
  - Obstruction
  - Inflammatory conditions (e.g. Appendicitis)

CONTRAST STUDIES

1.) Single-contrast method

- Barium sulfate
- Water-soluble iodinated CM

2.) Double-contrast method

- Single-stage procedure
  - Barium and gas injects at the same time
  - **7-PUMP METHOD (MILLER METHOD)** is performed
    - **Advantages:**
      - Reduces cost
      - Saves time
      - Reduces radiation exposure
  - **Barium suspension:** 200% weight-to-volume
  - **Important criteria:**
    - Patient's colon must exceptionally empty
    - Suitable barium suspension be used
    - Barium must flow sufficiently to coat the walls of the colon (most important)
- Two-stage procedure **(WELIN METHOD)**
  - **Welin stressed:** importance of preparing the intestine
    - Colon must be cleansed as thoroughly as possible
    - Colonic mucosa must be prepared in such a way that an **extremely thin** and **even coating of barium** can **adhere to the colonic wall**
  - **1st stage:** Barium sulfate
    - **Prone –** to prevent possible ileal leak
    - Colon is filled to **left colic flexure**
    - **Right lateral projection** of barium filled rectum
  - **2nd stage:** air enema (after evacuation of $BaSO_4$)
    - **Prone**
      - To prevent possible ileal leak
      - To prevent overlap of SI on rectosigmoid area
      - Aids in adequate drainage of excess barium from rectum
    - **Welin stressed:** importance of instilling enough air (**1800-2000 mL or more**)
      - To obtain proper distention of colon
  - **Advantages:**
    - Reveals even small intraluminal lesions
    - Valuable in **early diagnosis** of **ulcerative colitis**, **regional enteritis** and **polyps**
  - **Examination time:** no more than 20-25 minutes
    - **Welin recommendation:** regulation of evacuation
      - To avoid unnecessary waiting time
- **Contrast media:** demonstrates
  - Anatomy of the colon

- Tonus of the colon
- Abnormalities of the colon

- **Gaseous medium:**
  - To distend the lumen of the bowel
  - To visualize any small intraluminal lesions (e.g. polypoid tumors)
  - To render visibility of the barium-coated mucosal lining

COMPUTED TOMOGRAPHY COLONOSCOPY (CTC)

- Virtual colonoscopy (VC)
- Used as primary screening tool for colorectal cancer
- Used after a failed of conventional colonoscopy

EQUIPMENT AND SUPPLIES

- Disposable soft plastic enema tips
- Disposable enema bags
  - **Capacity:** 3 quartz (3000 mL) or 500 mL (small enema bags)
  - **Tubing:** 6 feet long
- Soft rubber rectal catheter (small caliber)
  - **Indicated:** patient with
    - Inflamed hemorrhoids
    - Fissures
    - Strictures
- Retention catheters
  - **Old:** Bardex or Foley catheter
  - **New:** Disposable rectal retention tips
    - Balloon cuff
    - Enema nozzle
    - Reusable squeeze inflator – limit the **air capacity** of **balloon cuff** to **90 mL**
  - Extreme care must be taken when inserted
    - **Rationale:** possible intestinal wall damage
- Enema retention tips
  - **Types:**
    - Plastic disposable
    - Rectal retention/retention catheters
      - For patient with relaxed anal sphincters
      - For patient who cannot retain enema
    - Double contrast retention enema tips
- Barium enema container
  - Open-system enema container
    - Old type system
  - Closed-system enema container
    - Replaced the open-type system
    - **Advantages:**
      - More convenient
      - Reduced risk of cross-infection
- Disposable enema bag with tubing
- Barium sulfate
- Enema tips

LATEX ALLERGIES

- **Caused by:** gloves, catheters, enema tip, tubing & other latex devices
- Patient may experience **anaphylactoid-type reactions**
  - Sneezing
  - Redness
  - Rash
  - Dyspnea
  - Death

SPECIAL PROCUDURE
(LGIS)

CONTRAST MEDIA

- **Colloidal preparations:** commercially prepared $BaSO_4$ products
  - Premixed liquids
  - Powder
- **Flocculation-resistant preparations:** contain some form of suspending or dispersing agent
- **Mixing preparation:** follow the manufacturer's instruction (best recommendation)
- **Warm Ba Administration**
  - **Temperature:** 80-90^{o}F (29-30^{o}C)
    - Below body temperature
  - **Too warm:**
    - Injurious to intestinal tissues
    - Produces so much irritation
- **High density BaSO4:** newest barium products
  - Absorb a greater percentage of radiation than thick Ba products
  - Useful for double contrast studies
- **Single contrast**
  - **Barium concentration:** b/n 15%-25% weight-to-volume
- **Double contrast**
  - **Barium concentration:** b/n 75%-95% weight-to-volume or higher
- **Air-contrast study:**
  - Air, Nitrogen and Carbon dioxide
  - **CO_2:** commonly used
    - **Rationale:**
      - More rapidly absorbed than nitrogen
      - Well tolerated by the LI
- **Air or CO2 insufflation:** used to perform CTC/VC
- **Barium sulfate suspension**
  - **Advantages:** not subject to
    - Drying
    - Flaking
    - Unequal distribution in the colon
- **Water-soluble iodinated CM:**
  - **Indicated:**
    - Perforated or lacerated intestinal wall
    - When patient is scheduled for surgery after the BE
  - **Advantage:** allows satisfactory examination of the colon for uncooperative patient
  - **Disadvantages:**
    - Insufficient for satisfactory double-contrast visualization of the mucosal pattern
    - **Rationale:** nonabsorbable from the GI mucosa
    - Subject to drying, flaking & unequal distribution in the colon
  - **When retrograde filling is contraindicated:** administer orally
    - **Transit time:** 3-4 hours (fast)
- **CT Scan of LI**
  - **Barium suspension:** low weight-to-volume
    - **Rationale:** to prevent artifacts from obscuring the anatomy
- **Evacuative proctogram**
  - **Barium suspension:** 100% weight-to-volume (minimum)

SPECIAL PROCUDURE
(LGIS)

INSERTION OF ENEMA TIPS

- Sims' position (LAO 35-40^{o})
  - Relaxes the abdominal muscles
  - Decreases intraabdominal pressure on the rectum
  - Makes relaxation of the anal sphincter less difficult
- **IV pole:** no higher than **24 in. (61 cm) above the level of anus**
- Run a little barium mixture into a waste basin
  - **Rationale:** to free the tubing with air
- Advise patient to relax and take a deep breaths
  - **Rationale:**
    - To prevent discomfort during tube insertion
    - To relax abdominal muscle and anal sphincter
- Elevate the right buttock laterally
  - **Rationale:** to open the gluteal fold
- **Tube insertion:**
  - Follow the angle of anal canal
    - Direct tube **anteriorly 1-1.5 in.** (2.5-3.8 cm)
  - Then follow the curve of rectum
    - Direct tube **superiorly**
  - **Total distance:** no more than **4 in. (10 cm)**
    - **>4 in.:** may injure the rectum
  - **TAKE NOTE:**
    - Patient may assist if capable
    - Never forcibly insert rectal tube

PROJECTIONS FOR SINGLE-CONTRAST BE

- PA/AP projection
- PA Obliques
- Axial projection – for sigmoid
- Lateral projection – for rectum

PROJECTION FOR DOUBLE CONTRAST BE

- **1st Sequence:** Prone
  - PA, TWO PA Obliques (RAO & LAO) & Right Lateral Projection
  - To include rectum
- **2nd Sequence:** Supine
  - AP & 2 AP Obliques (RPO & LPO)
  - To include transverse colon and its flexures
- **3rd Sequence:** Lateral Decubitus Position
  - 2 AP Projections (R & L Lateral decubitus)
  - To include rectum
- **4th Sequence:** Upright
  - PA & 2 PA Oblique projections (RAO & LAO)

PREEVACUATION RADIOGRAPH

- For demonstration of otherwise **obscured flexed** or **curved areas** of the LI

POSTEVACUATION RADIOGRAPH

- To evaluate if the barium is adequately evacuated
- **Inadequate evacuation:**
  - Give patient hot beverage (tea or coffee)
    - **Rationale:** to stimulate further evacuation

ENTEROSTOMY

- Enteron = *"intestine"*; stoma = *"opening"*
- General term applied to the surgical procedure of forming an artificial opening to the intestine (through abdominal wall)
- **Regional terms:** Colostomy, Cecostomy, Ileostomy & Jejunostomy
- **Colon:** most common site of disease in LI
- **Loop colostomy:** perform to divert the fecal column from areas of diverculitis or

ulcerative colitis (either temporary or permanent)
- **Stoma:** artificial opening; no sphincter

DEFECOGRAPHY
- Evacuation proctogaphy or dynamic rectal examination
- New radiologic procedure
- Performed on patient with defecation dysfunction
- No patient preparation is necessary
- Cleansing enemas not recommended
    - **Rationale:** water remaining in the rectum dilutes the CM

POSITIONING ROUTINES

PA PROJECTION
PP: Prone
- **Trendelenburg position:** helps separate redundant and overlapping loops of the bowel by "spilling" them out of pelvis

RP: Iliac crest
CR: Perpendicular
SS: Entire colon

PA AXIAL PROJECTION
Butterfly Position
PP: Prone
RP: MSP at level of ASIS
CR: 30-40^{o} caudad
SS: Best demonstrate rectosigmoid area

PA OBLIQUE PROJECTION
RAO Position
PP: Prone; RAO 35-45^{o} (side down is demonstrated)
RP: 1-2 in. lateral to MSP of elevated iliac crest
CR: Perpendicular
SS: Best demonstrates
- Right colic flexure
- Ascending portion of colon
- Sigmoid portion of colon

LAO Position
PP: Prone; LAO 35-45^{o} (side down is demonstrated)
RP: 1-2 in. lateral to MSP of elevated iliac crest
CR: Perpendicular
SS: Best demonstrates
- Left colic flexure
- Descending portion of colon

LATERAL PROJECTION
R or L Position
PP: Lateral recumbent (R or L)
RP: MCP at level of ASIS
CR: Perpendicular
SS: Best demonstrates
- Rectum
- Distal sigmoid portion of colon

AP PROJECTION
PP: Supine
RP: Iliac crest
CR: Perpendicular
SS: Entire colon

AP AXIAL PROJECTION
Butterfly Position
PP: Supine
RP:
- 2 in. inferior to ASIS or
- Inferior margin of pubic symphysis (when collimated)
    - For demonstration of rectosigmoid region

CR: 30-40^{o} cephalad
SS: Best demonstrate rectosigmoid area

SPECIAL PROCUDURE
(LGIS)

AP OBLIQUE PROJECTION
LPO Position

PP: Supine; LPO 35-45^{o} (side up is demonstrated)
RP: 1-2 in. lateral to MSP of elevated iliac crest
CR: Perpendicular
SS: Best demonstrates

- Right colic flexure
- Ascending portion of colon
- Sigmoid portion of colon
- **Takenote:** same as RAO

RPO position

PP: Supine; RPO 35-45^{o} (side up is demonstrated)
RP: 1-2 in. lateral to MSP of elevated iliac crest
CR: Perpendicular
SS: Best demonstrates

- Left colic flexure
- Descending portion of colon
- **Takenote:** same as LAO

RIGHT LATERAL DECUBITUS
AP/PA Projection

PP: Right lateral decubitus position
RP: Iliac crest
CR: Horizontal
SS: AP/PA projection of contrast-filled colon

- Best demonstrates **"up" medial side** of **ascending colon**
  - When colon is inflated with air
- Best demonstrates **"up" lateral side** of **descending colon**
  - When colon is inflated with air

LEFT LATERAL DECUBITUS
AP/PA Projection

PP: Left lateral decubitus position
RP: Iliac crest
CR: Horizontal
SS: AP/PA projection of contrast-filled colon

- Best demonstrates **"up" lateral side** of **ascending colon**
  - When colon is inflated with air
- Best demonstrates **"up" medial side** of **descending colon**
  - When colon is inflated with air

VENTRAL DECUBITUS
R or L Lateral Projection

PP: Prone; R or L side against vertical grid
RP: Iliac crest
CR: Horizontal
SS: Lateral projection of contrast-filled colon

- Best demonstrates **"up" posterior portion** of the **colon**
- This position is **most valuable in double contrast examination**

AP, PA, OBLIQUE & LATERAL PROJECTION
Upright Position

- Identical to those for recumbent position
- **IR** is **placed** at **lower level**
  - **Rationale:** to compensate for the drop of the bowel because of the effect of gravity

MODIFICATION/METHOD IN BE

BILLING'S MODIFICATION

PP: Supine
CR: 35-45^{o} cephalad
SS: Demonstrates rectosigmoid colon
ER: Used to prevent overlapping of loops

OPPENHEIMER'S MODIFICATION

PP: Supine
RP: 1 in. proximal to upper border of symphysis pubis
CR: 12^{o} caudally
SS: Demonstrates rectosigmoid colon

SPECIAL PROCUDURE
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FLETCHER'S MODIFICATION

PP: LAO
RP: 2 in. medial to elevated ASIS
CR: 30-35^{o} cephalad
SS: Best demonstrates rectosigmoid colon

ROBIN'S MODIFICATION
-most important modification in BE-

PP: Left lateral position
RP: 2 in. posterior to midaxilliary plane
CR: Perpendicular
SS: Demonstrates direct lateral view of the rectosigmoid colon without overlapping

CHASSARD-LAPINE METHOD
JACK KNIFE POSITION
AXIAL PROJECTION

Chassard-Lapine: projection is made at almost **right angle to the AP projection**

- Demonstrates anterior and posterior surfaces of the lower portion of the bowel
- Permits the coils of the sigmoid to be projected free from overlapping
- **Taken:**
    - Postevacuation radiograph of LI
    - Preevacuation radiograph of LI
        - Only when patient has reasonably sphincter control

PP: Seated at the edge of table; thigh abducted; IR center to pelvis; lean directly forward; grasps ankle for support
RP: Lumbosacral region at level of greater trochanter
CR: Perpendicular
SS: Axial projection of the

- Rectum
- Rectosigmoid junction
- Sigmoid

WELIN TECHNIQUE

- **Valuable in early diagnosis of:**
    - Ulcerative colitis
    - Regional enteritis
    - Polyps
- **Air instilled:** 1800-2000 cc or more

-THE END-

"Board Exam is a matter of preparation. If you FAIL to prepare, you PREPARE to fail"
05/26/14